From the Author.

ADDRESS

DELIVERED AT

THE ANNIVERSARY MEETING

OF THE

GEOLOGICAL SOCIETY OF LONDON,

On the 19*th of* FEBRUARY, 1875;

PREFACED BY

THE ANNOUNCEMENT OF THE AWARD

OF

THE WOLLASTON MEDAL,

THE PROCEEDS OF THE DONATION-FUND,

AND THE MURCHISON MEDAL

AND GEOLOGICAL FUND

FOR THE SAME YEAR.

By JOHN EVANS, Esq., V.P.R.S.,

PRESIDENT OF THE SOCIETY.

LONDON:

PRINTED BY TAYLOR AND FRANCIS,

RED LION COURT, FLEET STREET.

1875.

ADDRESS

DELIVERED AT

THE ANNIVERSARY MEETING

OF THE

GEOLOGICAL SOCIETY OF LONDON,

On the 19*th of* FEBRUARY, 1875;

PREFACED BY

THE ANNOUNCEMENT OF THE AWARD

OF

THE WOLLASTON MEDAL,

THE PROCEEDS OF THE DONATION-FUND,

AND THE MURCHISON MEDAL

AND GEOLOGICAL FUND

FOR THE SAME YEAR.

BY JOHN EVANS, ESQ., V.P.R.S.,

PRESIDENT OF THE SOCIETY.

LONDON:

PRINTED BY TAYLOR AND FRANCIS,

RED LION COURT, FLEET STREET.

1875.

PROCEEDINGS

AT THE

ANNUAL GENERAL MEETING,

19TH FEBRUARY, 1875.

Award of the Wollaston Medal.

The Reports of the Council and of the Library and Museum Committee having been read, the President, John Evans, Esq., V.P.R.S., presented the Wollaston Gold Medal to Professor de Koninck, F.M.G.S., addressing him as follows:—

Monsieur le Docteur de Koninck,

It is my pleasing duty to place in your hands the Wollaston Medal, which has been awarded to you by the Council of this Society in recognition of your extensive and valuable researches and numerous geological publications, especially in Carboniferous Palæontology. These researches are so well known, and have gained you so world-wide a reputation, that I need say no more than that your Palæontological works must of necessity be almost daily consulted by all who are interested in the fauna of the Carboniferous period. Already in 1853 the numerous and able Palæontological works which you had published in the preceding twenty years had attracted the grateful notice of the Council of this Society, who in that year begged you to accept the balance of the proceeds of the Wollaston Fund, in aid of the publication of your work on *Encrinites*, then in progress. It was in the same year that the Society had the satisfaction of electing you a Foreign Member of their body; and now, after a second period of rather more than twenty years devoted to the study not only of Geology and Palæontology but also of chemical analysis, I have the pleasure of conferring upon you the highest additional honour it lies in the power of this Society to bestow, by presenting you with the Medal founded by the illustrious Wollaston, who was himself also a Chemist as well as a Geologist. If any thing could add to the satisfaction we feel in thus bestowing the Medal, it is your presence among us this day, which will enable you more

fully to appreciate our unanimous sense of the high value of your labours in the cause which we all have at heart.

Prof. de Koninck, in reply, said:—

Monsieur le Président, Messieurs,

La langue anglaise m'étant trop peu familière pour me permettre de m'en servir, afin de vous exprimer toute ma reconnaissance pour le grand honneur que vous venez de me faire, en me décernant la Médaille de Wollaston, j'espère que vous voudrez bien me permettre dans la circonstance solennelle dans laquelle je me trouve, de faire usage de l'idiôme dont on se sert habituellement dans mon pays.

Laissez-moi vous dire d'abord, Messieurs, qu'il m'a semblé que ma présence au milieu de vous était le plus sûr moyen de vous donner la preuve de mes sentiments de gratitude et du prix que j'attache à la distinction dont je vous suis redevable.

Cette distinction sera pour moi un nouvel encouragement et un stimulant pour continuer et pour achever, si possible, mes travaux concernant la faune carbonifère de mon pays. L'étude de cette faune, qui doit comprendre plus de 1200 espèces, m'a conduit à des résultats très-remarquables. J'espère que je pourrai bientôt vous en fournir la preuve et vous démontrer qu'elle se compose de trois grands groupes parfaitement distincts entre eux, quoique possédant un certain nombre d'espèces identiques et dont le premier est presque exclusivement formé des espèces recueillies dans le calcaire de Tournai, le deuxième des espèces des environs de Dinant, et le troisième de celles du calcaire de Visé et de quelques lambeaux de ce même calcaire des environs de Namur.

Ces faunes sont principalement représentées chez vous, la première en Irlande, à Hook Point et ses environs, la deuxième aux environs de Dublin, et la troisième en Écosse et au centre de Yorkshire, où elle a été l'objet des remarquables recherches de notre savant et regretté confrère le Professeur J. Phillips.

C'est par ces travaux, Messieurs, que je compte terminer ma carrière scientifique, si les forces nécessaires et la santé ne me font pas défaut, et continuer ainsi à mériter votre haute et impartiale approbation.

Award of the Wollaston Donation-fund.

The President then presented the Balance of the proceeds of the Wollaston Donation-fund to Mr. L. C. Miall, of Leeds, and addressed him in the following terms:—

Mr. Miall,

I have much pleasure in presenting you with the Balance of the Proceeds of the Wollaston Fund, which has been awarded you by the Council of this Society to assist you in your researches on Fossil Reptilia.

Those who had the good fortune to be present at the meeting of the British Association at Bradford in 1873, and to hear the masterly Report of the Committee on the Labyrinthodonts of the Coal-measures, drawn up by yourself, and those also who have studied the Paper which you have communicated to this Society on the remains of Labyrinthodonta from the Keuper Sandstone of Warwick, must be well aware of the thorough and careful nature of your researches, carried on, I believe, in a somewhat isolated position, and remote from those aids which are so readily accessible in the metropolis and some of our larger towns. I trust that the proceeds of this fund which I have now placed in your hands will be regarded as a testimony of the interest which this Society takes in your labours, and may also prove of some assistance to you in still further prosecuting them.

Mr. Miall, in reply, said that he felt that his sincere thanks were due to the Geological Society for awarding him the balance of the proceeds of the Wollaston Donation-fund as a token of appreciation of the little work that he had been able to do, and also to the President for the terms in which he had been kind enough to speak of him. He should regard this donation, not only as an honour received by him, but also as a trust to be expended to the best of his power in accordance with the intentions with which it had been conferred upon him by the Society.

Award of the Murchison Medal and Geological Fund.

The President next handed the Murchison Medal to Mr. David Forbes for transmission to Mr. W. J. Henwood, F.R.S., F.G.S., and spoke as follows:—

Mr. David Forbes,—

In placing the Murchison Medal and the accompanying cheque in your hands, to be conveyed to our distinguished Fellow, Mr. William Jory Henwood, I must request you to express to him our great regret that he is unable to attend personally to receive it. His researches on the metalliferous deposits, not only of Cornwall and Devonshire, but of Ireland, Wales, North-western India, North

America, Chili, and Brazil, extending as they do to questions of subterranean temperature, electric currents, and the quantities of water present in mines, are recorded in memoirs which form text-books for mining students. They have for the most part been contributed to the Royal Geological Society of Cornwall, which has taken a pride in publishing them; but I trust that it will be a source of satisfaction to Mr. Henwood, after fifty years of laborious research, and amidst the physical suffering caused by a protracted illness, to receive this token of appreciation at the hands of another Society which takes no less interest in the subjects of his investigations.

Mr. David Forbes said that in receiving the Murchison Medal, on behalf of Mr. W. J. Henwood, he was commissioned by that gentleman to express his great regret that the bad state of his health and his advanced age prevented his appearing in person to thank the Council for the high honour they had conferred upon him, and the extreme gratification he felt in finding that the results of his labours in the investigation of the phenomena of mineral veins, which had extended over more than fifty years, had thus been recognized by the Geological Society of London.

The President then presented to Prof. H. G. Seeley, F.L.S., F.G.S., the balance of the Murchison Geological Fund, and said:—

Mr. Seeley,—

Your researches in Geology and on fossil Osteology have now already extended over a period of upwards of sixteen years; and the numerous and valuable essays which you have contributed to the 'Annals and Magazine of Natural History,' as well as to the Quarterly Journal of this Society, are only a portion of their fruits. Your separate works on the fossil remains of Aves, Ornithosauria, and Reptilia in the Woodwardian Museum at Cambridge, and on the bones of Pterodactyles, are well known to every student of fossil osteology, and have been thought worthy of the by no means empty compliment of being printed at the expense of the Syndics of the University Press of Cambridge.

The esteem in which your researches are held by the Council of this Society, and their hope that you may still be enabled to prosecute them, are best evinced by their presenting you with the balance of the proceeds of the Murchison Fund, which I now have the pleasure of placing in your hands.

Prof. Seeley replied as follows:—

Mr. President,—

I have ever been taught that the Geological Society is the fountain of geological honour. It has always been a great honour to be associated with the Fellows of this Society, who are constructing the science we cultivate. Out of this association have grown bonds of comradeship, encouraging some of us to follow on in the labours of those whose work is ended; and when, Sir, I receive at your hands this award of the Balance of the Murchison Fund, I am grateful for such a distinguished mark of sympathy with my special studies, and shall be encouraged by it to prosecute researches which I hope may be better worthy of the Society's acceptance.

THE ANNIVERSARY ADDRESS OF THE PRESIDENT,

John Evans, Esq., V.P.R.S.

The first duty which I now have to perform, in accordance with the long-established custom of this Society, is to notice briefly the lives and works of those who during the last twelve months have passed away.

Foremost among those whose removal by death from among us we this year have to deplore, I must place Professor John Phillips, whose sad and sudden end on the 24th of April last caused so deep and heartfelt a sorrow throughout the whole country. We more especially grieved at the death of one so renowned as a geologist—one who for so many years had been a distinguished Member of our body, and who at a former time had so worthily occupied the Presidential Chair. From his earliest days his name had been associated with our science; and, both by his relationship and his intimate connexion with William Smith, he formed one of those few surviving links which remained to connect the geologists of the present day with those who may be said to have been the guardians and tutors of the infant science. He was not, however, one who was unable to keep pace with the more matured advances of geology, as will be seen when we come to consider the list of his geological works. At the same time his scientific acquirements were such as to enable him to make his mark both in astronomy and meteorology, while

his services to the cause of science generally in connexion with the British Association for the Advancement of Science, of which, indeed, he was one of the founders, can never be overrated. I must, however, now proceed to give some account of his life and works; and, so far as the earlier portion of his life is concerned, I am fortunate in being able to do so in his own words, as recorded in the 'Athenæum' newspaper, May 2, 1874.

"I was born on the happy Christmas Day, 1800, at Marden, in Wiltshire, the moment being noted by my father with the exactitude suited to a horoscope. He was the youngest son of a Welsh family, settled for very many generations on their own property at Blaen-y-ddol, in Carmarthenshire, and some other farms near it. On their possessions, much reduced from their ancient extent, my grandfather died in the beginning of this century. My father, born in 1769, was trained for the Church, in which some of his relations had place; but this plan was not carried out. He came to England, was appointed an Officer of Excise, and married the sister of dear old William Smith, of Churchill, in Oxfordshire.

"My first teachings were under his eye, and I may say hand, for he now and then employed the *argumentum baculinum*, though very gently. But he died when I was seven years old; my mother soon after; and my subsequent life was under the friendly charge of my great relative, a civil engineer in full practice, known as 'Strata Smith.'

"When I was nine years of age, my uncle Smith took me by the hand, while walking over some cornbrash fields near Bath, and showed me the Pentacrinite-joints. He afterwards immersed them in vinegar, to show the extrication of carbonic acid and the flotation or 'swimming' of the fossils.

"Before my tenth year I had passed through four schools, after which I entered the long-forgotten, but much to be commended, old school at Holt Spa, in Wiltshire. Lately I rode through the village, and was sorry to find the place deprived of all that could be interesting to me. At Holt School a small microscope was given to me, and from that day I never ceased to scrutinize with magnifiers plants, insects, and shells. In after life this set me on *making* lenses, microscopes, telescopes, thermometers, barometers, electrophori, anemometers, and every kind of instrument wanted in my researches.

"When you see me now χαλεπῶς βαδίζων, tired with the ascent of Gea Fell and the rough path to the Zmütt Glacier, you will hardly credit me as the winner of many a race, and the first in

many a desperate leap. My work at this school was incessant for five years. I took the greatest delight in Latin, French, and Mathematics, and had the usual lessons in drawing. We were required to write a good deal of Latin, especially our Sunday theme; of such, I wrote many for my idle associates. I worked through Moles's Algebra and Simson's Euclid, the first two books completely and selections of the others. The French master was a charming old Abbé, a *réfugié*, whose patience and good nature and perseverance were quite above praise. We spoke and wrote French in abundance. Of Greek I learned merely the rudiments, to be expanded in after life. I did not work at German till some years later: Italian I merely looked at.

"From the tragedies and comedies of school I passed to a most pleasant interlude, by accepting a twelve-months' invitation to the home of my ever-honoured friend, the Rev. Benjamin Richardson, of Farleigh Castle, near Bath, one of the best naturalists in the west of England, a man of excellent education, and a certain generosity of mind, very rare and very precious. Educated in Christ Church, he retained much of the undefinable air of a gentleman of Old Oxford; but mixed with this there was a singular attachment to rural life and farming operations. Looking back through the vista of half a century, among the ranks of my many kind and accomplished friends, I find no such man; and to my daily and hourly intercourse with him, to his talk on plants, shells, and fossils, to his curiously rich old library, and sympathy with all good knowledge, I may justly attribute whatever may be thought to have been my own success in following pursuits which he opened to my mind.

"From the Rectory at Farleigh, where science and literature were seen under colours most attractive to youth, I was transferred, by the good old Bath coach, to my uncle Smith's large house, which looked out on the Thames from the eastern end of Buckingham Street. Here a kind of life awaited me which, remembered at this long distance of time, excites sometimes my wonder, at other times my amusement, not seldom regret, but always my thankfulness. Here was a man in the exercise of a lucrative and honourable profession, who had for many years given every spare moment and every spare shilling to the execution of that vast work, the 'Map of the Strata of England and Wales.' After that was published, in 1815, he continued his labours in more detail, and issued twenty-one English County Maps, coloured geologically, after personal examination in each district. His home was full of maps, sections,

models, and collections of fossils; and his hourly talk was of the laws of stratification, the succession of organic life, the practical value of geology, its importance in agriculture, engineering, and commerce, its connexion with physical geography, the occupations of different people, and the distribution of different races. In this happy dream of the future expansion of geology, his actual professional work was often forgotten, until at length he had thrown into the Gulf of the Strata all his little patrimony and all his little gains; and he gave up his London residence and wandered, at his own sweet will, among those rocks which had been so fatal to his prosperity, though so favourable to his renown. In all this contest for knowledge, under difficulties of no ordinary kind, I had my share. From the hour I entered his house in London, and for many years after he quitted it, we were never separated in act or thought. In every drawing or calculation which his profession required, in every survey for canal or drainage, or colliery or mine, I had my share of work; for every book, map, and tour my pencil was at his command. And thus my mind was moulded on his. And it seemed to be my destiny to mix, as he had done, the activity of a professional life with the interminable studies of geology.

"Thus passed the time till the spring of 1824, when, by the invitation of the Yorkshire Philosophical Society, then lately established, my uncle went to York to deliver a course of lectures on Geology, and I was his companion. This was the crisis of my life. From that hour the acquisitions I had made in Natural History and 'Fossilogy,' as we then termed the magnificent branch of study now known as Palæontology, brought me perpetual engagements in Yorkshire to arrange museums and give lectures on their contents to members of literary and philosophical societies. In this manner most of the Yorkshire towns which were active in promoting museums of Natural History and Geology were repeatedly visited: York, Scarborough, Hull, Leeds, and Sheffield became centres of most valuable friendships; and the great county, in which thirty thoughtful years were afterwards passed, became known to me as probably to no others. The generous Yorkshire people gave no stinted remuneration for my efforts to be useful; and I employed freely all the funds which came to my hands in acquiring new and strengthening old knowledge, so as to be able to offer instruction in almost any department of Nature, but especially in Zoology and Geology.

"By degrees Birmingham, Manchester, Liverpool, Chester, New-

castle, and other places offered me advantages of the same kind as those which always welcomed me at home; and when, in 1831, the British Association was formed, my circle of operations had reached the University College, London, then under the wardenship of Mr. Leonard Horner. At this time I had been resident in York for five years, having the care of the Yorkshire Museum and the office of Secretary of the Yorkshire Philosophical Society. In this capacity it was my good fortune to be associated with Mr. W. V. Harcourt, the first President of that Society, and to assist in the establishment of the great Association which he had so large a share in organizing, with Brewster, Forbes, Johnston, Murchison, and Daubeny. After this the whole book of my life has been open for the public to read. Educated in no college, I have professed Geology in three Universities, and in each have found this branch of science firmly supported by scholars, philosophers, and divines."

These three universities were successively London, Dublin, and Oxford. It was in the year 1828 that he had become a Fellow of this Society; and in 1834 he was elected a Fellow of the Royal Society, and accepted the Professorship of Geology in King's College, London, an appointment which he held for six years. In 1844 he was appointed Professor of Geology in Trinity College, Dublin. Nine years later, in 1853, Professor Phillips virtually attained the position which he ever since occupied with so much advantage to the progress of science. In the autumn of that year, Mr. Hugh Strickland came to a melancholy end, in a manner which gave to the scientific men of that day almost as severe a shock as that produced on our minds by the sad death of Professor Phillips. Mr. Strickland was examining the geological structure of a railway-cutting, when he was knocked down and killed by a passing train. The deceased gentleman had been engaged for some time in lecturing on geology at Oxford, in place of Dr. Buckland, who was then unable, from ill-health, to perform the duties of his Readership. Professor Phillips accepted the position thus vacated, and afterwards, on the death of Dr. Buckland in 1856, succeeded to the post of Reader in Geology in the University of Oxford. Of the mode in which he performed the duties of that important office there can be but one opinion. As a lecturer, his qualifications were always of the highest order; his knowledge, most various and profound, was communicated in a lucid and genial style, which not only rivetted the attention of his hearers, but imparted to them some of his own enthusiasm. But perhaps the greatest service that he rendered to

geology during his residence at Oxford was the aid afforded by him in the foundation and arrangement of the new museum belonging to that University, which now contains one of the finest and best collections to be found in this country. From each of the Universities of Dublin, Cambridge, or Oxford he received the honorary degree either of LL.D. or D.C.L.

In 1845 the Wollaston Medal was awarded to Mr. Phillips, then Professor of Geology in the University of Dublin, for the services he had rendered to geology by his various published works. In the years 1859 and 1860 he was President of this Society, to which, during the course of his membership, he communicated several papers. Of these, perhaps, the most important are, "On a Group of Slate Rocks in Yorkshire" and "On some Sections of the Strata near Oxford."

He also contributed a large number of geological essays to the 'Philosophical Magazine,' the 'Reports' of the British Association and of various local societies, as well as an important treatise on the Malvern Hills to the 'Memoirs of the Geological Survey.'

This Survey he had joined in April 1845, and retained the post of "Geologist" to it until the latter part of 1849. He had already, in 1841, prepared for its memoirs the "Figures and Descriptions of Palæozoic Fossils of Cornwall, Devon, and West Somerset," in illustration of Sir Henry de la Beche's report on the district.

His communications to the Royal Society were principally in connexion with the planet Mars, the appearances of which he had long and carefully studied.

Meteorology also was one of his studies at a time when it was little thought of; and in addition to publishing his 'Three Years' Observations on Rain at different heights from the ground,' he invented, for meteorological purposes, several instruments, including a pluviometer for recording the direction and inclination of rain, a peculiar form of anemometer, and a maximum thermometer, in which, by a break in the column of mercury, it is made to serve as its own index. Professor Phillips was also associated with General Sabine in the magnetic survey of the British Isles, and with Mr. Blackwell in the inquiry into the nature of fire-damp in coal-mines, which led to the appointment of the existing staff of inspectors.

As Secretary to the British Association he arranged and edited no fewer than twenty-seven volumes of the Reports of that body, of which he was the President for the year 1864.

Of his separate works may be cited:—

A 'Treatise on Geology,' which has gone through two editions (1837, 1852).

A 'Guide to Geology,' which reached its fifth edition in 1864.

Illustrations of the Geology of Yorkshire (2 vols. 4to), 1829–36, on a new edition of which he was engaged at the time of his death.

Life on the Earth, its Origin and Succession, 1860.

Vesuvius, 1869.

Geological Map of the British Isles, 1842.

Memoirs of William Smith, LL.D., 1844.

The Geology of Oxford and the Valley of the Thames. Published in 1871.

Of the personal qualities of one who was so well known to the Society, I need hardly speak. Eminently judicious, ever courteous, genial, and conciliatory, he gained the affection of all with whom he was brought in contact; while in cases where conflicting views required to be reduced into harmony, and strong feelings to be smoothed, his tact and judgment were often able to prevail where the more strenuous efforts of others would have been powerless.

While still in full activity of mind and health of body, although already in his 74th year, an accidental fall downstairs when engaged in conversation with a friend, produced injuries from which he never rallied, and which, on the following day, resulted in his death.

While on this side of the Channel we have to lament the loss of so distinguished a veteran in Geology as Professor Phillips, our neighbours in France and Belgium have to deplore the death of two men of no less eminence, whose names had been among the foremost in geological science for even longer periods,—I mean M. Élie de Beaumont and M. d'Omalius d'Halloy.

M. J. B. A. L. L. Élie de Beaumont was born Sept. 25, 1798, and in 1817 was admitted a pupil in the École Polytechnique, which he quitted after a brilliant course of study in 1819, when he was placed as first among those who then quitted the school. He next entered the École des Mines, where he gained the esteem and affection of all the professors, as he had already done at the École Polytechnique. It was here that he first evinced his great taste and intuitive disposition for geology; and a letter of M. Brochant de Villiers, written while he was still in his second year in the school, has been cited by M. Daubrée as testifying to the fact.

In 1822 a circumstance occurred which determined his future course, and English geologists may well claim some credit in connexion with it. It was in the year 1820 that the Geological Map of England, by the late Mr. Greenough, was issued by this Society; and a copy having been sent to the École des Mines, the authorities were so much struck with the importance of the work that two years later it was determined to attempt the same thing for France. In order to do this in the best manner, it was thought well to send geologists to England to study the principles on which the map had been prepared, and to obtain information with regard to our mines and metallurgical establishments. For this purpose M. Brochant de Villiers associated with him the two young engineers M. Dufrénoy and M. Élie de Beaumont, and spent six months upon his mission. Their report, full of valuable and practical information, has served as a model for subsequent publications of the same character, and produced most beneficial results on the progress of metallurgy in France.

In 1824 M. Élie de Beaumont was sent to Rouen, where he remained until 1827, though taking an active part in the production of the Geological Map of France, which was commenced in 1825. During the eighteen years which sufficed for the completion of this gigantic work, M. de Beaumont published a long series of important memoirs, which exercised the most important influence on the development of geological knowledge in France. He had already, in 1827, been appointed to assist his master, M. Brochant de Villiers, in the Chair of Geology at the École des Mines, and became his successor in 1835. The clearness of his language, his careful analysis of facts, and his original and profound views rendered his lectures at once attractive and impressive.

It was in 1829 that a communication of M. de Beaumont's to the Academy brought him into the foremost rank among the men of science in France. In it he asserted that the oldest ranges of mountains in that country were those of the Côte d'Or in Burgundy, that the Pyrenees and Apennines were of later date, that Mont Blanc belonged to a period still more recent, and that the St. Gothard was younger than Mont Blanc. These views were adopted by Brongniart and Arago; and thus encouraged, M. de Beaumont prosecuted his studies of the origin of mountain-ranges with renewed vigour, and his 'Systèmes des Montagnes' was the result, followed in after years by large additions of facts and the development of his great idea of the pentagonal network of mountain-chains. I

need hardly say that M. de Beaumont's views have not met with universal concurrence, either from geologists or mathematicians; nor do more than remind you that they have been ably controverted, amongst others, by Sir Charles Lyell, and also by Mr. Hopkins in his anniversary address to this Society in 1853.

But whether or not M. de Beaumont's views on this particular question will stand the test of time, and of an extension in our knowledge of facts, his untiring industry and the startling boldness of his conceptions are such as must command our respect.

His brilliant abilities secured him a seat in the French Academy nearly forty years ago; and on the death of Arago in 1853 he was selected for the important post of Perpetual Secretary of that learned body, which he held up to the time of his unexpected decease on the 21st of September last.

After long service as Inspector-General of Mines he became, in 1861, Vice-President of the Conseil-Général des Mines and a Grand Officer of the Legion of Honour. He was also a Member of the French Senate from its first constitution. The premature loss of his wife and the miseries of the late war no doubt tended to hasten his end. During the siege of Paris and the subsequent horrors of the Commune he still remained at his post, and exhibited under trying circumstances the same boldness by which his writings had been characterized.

The extent and number of these writings can only be judged of by a more complete list than it is possible here to give; but his 'Géologie Pratique' may especially be noticed.

The part he took in the preparation of the Geological Map of France would, however, alone entitle him to the highest esteem. Engaged upon it from its commencement, nearly fifty years ago, he had, on his compulsory superannuation from the École des Mines in 1868, still retained the direction of the detailed maps—a task for the fulfilment of which he was so well qualified, and on which he was engaged almost up to the day of his death.

Another veteran geologist whose departure from among us we have this year cause to lament is Mons. Jean-Baptiste-Julien d'Omalius d'Halloy, Member of the Royal Academy of Belgium and Corresponding Member of the Institute of France. Born on the 10th of February, 1783, he had nearly completed his 92nd year at the time of his death, on the 15th of January last. His taste for geology was developed at an early period; for in 1806 we find him

communicating to the 'Journal des Mines' a paper on the occurrence of a lump of anthracite in the *calcaire à brachiopodes* of Visé, and in 1808 an essay on the Geology of the North of France. Of his subsequent geological works and treatises a longer list might be given than that which is here appended; but, to show their value, it may be mentioned that one of them, his 'Précis Élémentaire de Géologie,' has already reached its eighth edition, and that he was selected to write the articles on Géologie, Géognosie, and Géogénie in the 'Encyclopédie du XIX^{me} Siècle.'

As an ethnologist also he was well known, and his work 'Des races humaines, ou éléments d'éthnographie' has reached its fifth edition. On the occasion of the Congress of Prehistoric Archæology meeting at Brussels in the year 1872, it was he that was selected as president; and though at that time nearly ninety years of age, he entered fully into the objects of the congress, and took part in more than one of its discussions.

Although devoting so much of his time to scientific pursuits, M. d'Omalius d'Halloy's official duties were by no means light: beginning with the post of Maire of Skeuvre in 1807, he became Governor of the Province of Namur in 1815, and from the year 1848 he occupied a place in the Belgian Senate. His connexion with the Belgian Academy of Sciences dates from its re-establishment in 1816; and on three several occasions (in 1850, 1858, and 1872) he was President of that illustrious body. He had for forty-five years been a Foreign Member of our Society, having been elected on December 16, 1829, being at that time Governor of the Province of Namur, in the kingdom of the Netherlands. In a paper read to the Society on that evening, consisting of "Observations on part of the Low Countries and the North of France, principally near Maestricht and Aix-la-Chapelle," by Dr. Fitton, a just tribute was paid to the accuracy with which the general structure of the country had been described, even then "several years ago," by the careful observer who is the subject of this imperfect memoir.

Besides the important publications already mentioned the following may be cited:—'Coup d'œil sur la Géologie de la Belgique,' 8vo, 1842, and numerous communications to the Mémoires, Bulletins, and Annuaire de l'Académie Royale de Belgique, the 'Journal des Mines de France,' the 'Journal de Physique, de Chimie et d'Histoire Naturelle,' the 'Bulletins' of the Société Géologique de France and of the Société d'Anthropologie de Paris.

In Dr. Ferdinand Stoliczka, Palæontologist to the Geological Survey of India, our Society has lost another of its Fellows whom it could but ill afford to spare. On the 24th of June last, among the numerous communications which had unfortunately accumulated for the last evening of the session were two by Dr. Stoliczka, the one consisting of "Geological Observations made on a Visit to the Chaderkul, Thian-Shan Range," and the other of "Geological Notes on the Route traversed by the Yarkund Embassy from Shahidulla to Yarkund and Kashgar." Little did we think that the accomplished author of those papers, for which we then expressed our thanks, had already passed away beyond the reach of all human praise. His death had taken place on the 19th of that month, at Shayok, between the Karakorum Pass and Leh, in Ladak, whilst on the return from Kashgar and Yarkund with the other members of Mr. Forsyth's mission.

To adopt the words of one* who has had the advantage of long knowing him personally—

"Thus has passed away, at the early age of thirty-six, a naturalist who, if his life had been spared, would certainly have attained a very high position amongst the leaders of science. Few men have accomplished an equal amount of work in the same brief space of time. A glance at the Journal and Proceedings of the Bengal Asiatic Society, and the publications of the Geological Survey of India, especially the 'Palæontologia Indica,' will show the wonderful variety of subjects treated by Dr. Stoliczka. In the course of the last ten years, besides geological memoirs on parts of the Western Himalayas and Thibet, he has published numerous papers on Indian Mammals, Birds, Reptiles, Amphibia, Mollusca, Bryozoa, Arachnida, Coleoptera, and Actinozoa; and these papers are no lists of names or mere descriptions of new species, but they abound with accounts of the life-history of the different animals, details of their anatomy, and remarks on classification, and show that their author was as good an observer in the field as he was patient and accurate in the cabinet. His greatest work is undoubtedly his account of the fossil fauna discovered in the Cretaceous rocks of Southern India, in which he proposed the most complete general classification of Gasteropoda and Pelecypoda (*Lamellibranchiata*), including both fossil and recent forms, which has hitherto been attempted. This classification was largely supplemented by original anatomical re-

* This memoir, from the pen of W. T. B., appeared in 'Nature,' July 9, 1874.

search, and it has been adopted in one, at least (we believe in two), of the principal museums in Germany.

"Dr. Stoliczka was born in Moravia, in May 1838. After completing his university course he joined, whilst quite young, the Imperial Geological Institute of Austria, where he soon distinguished himself by his palæontological work, and became especially known for researches amongst the Bryozoa, fossil and recent. The collection of specimens belonging to that class obtained by the 'Novara' expedition was entrusted to him for description. Amongst his principal early contributions to palæontology were papers on the fossil fauna of the Hierlatz and Gosau beds.

"In 1862 he joined the Geological Survey of India, and at once commenced the study of the magnificent series of Cretaceous fossils obtained by Messrs. H. F. Blanford, C. Oldham, and the other officers of the Survey engaged in the Madras Presidency. The descriptions of these fossils have only recently been completed, and extend altogether to about 1500 quarto pages, illustrated by 178 plates. There can be no doubt of the rank of this work; it is one of the most complete monographs ever published of any fossil fauna whatever. The numerous duties connected with the post of Palæontologist to the Survey occupied so much of Dr. Stoliczka's time that he was only able to devote a few months in three different years to field-work. To this field-work we owe valuable reports on the Western Himalayas, Thibet, and Kachh, the last not yet published. In the year 1868 he accepted the honorary secretaryship of the Asiatic Society; and during the five years he held the post he raised the natural-history portion of the Society's journal to a position it had never approached before, this improvement being due no less to his own contributions than to the aid he was always ready to afford to all engaged in zoological inquiry.

"When, last year, a mission was despatched by the Indian Government to Yarkund and Kashgar, Dr. Stoliczka was selected to accompany it as naturalist and geologist. It would have been impossible to have found any one more competent for the post; but many of his friends knew the risk he ran, and he was well aware of it himself, for his health had been seriously affected by exposure in former years in the higher regions of the Himalayas, and he needed rest and a change to Europe. His life has been a sacrifice to the study to which he had devoted it. He was seriously ill at one time when crossing the high passes on his way to Yarkund, but recovered; and his letters from Kashgar gave glowing accounts of

his discoveries; and now, when returning loaded with the spoils and notes of nearly a year's research in one of the least-known parts of Central Asia, he has fallen, just as his friends were in hopes of welcoming him back amongst them. This is not the place to speak of his many amiable qualities, but few men were more widely known in India or more universally beloved and esteemed; and the gap he has left in the little band of Indian naturalists and geologists, as well as amongst the far wider circle of his private friends, will be long unfilled."

Dr. Robert Edmond Grant, the seventh son of Mr. Alexander Grant, W.S., was born in his father's house in Argyle Square, Edinburgh, on the 11th of November, 1793. He was one of a family of twelve, having eight brothers and three sisters, all of whom died long before him, so that for many years he was the sole survivor of his family. He received his early education from a private teacher; but when about ten years old he was sent to the High School of Edinburgh, where he remained for about five years, his favourite studies being Greek and Geometry. His school vacations were spent in pedestrian excursions among the hills and valleys of his native country.

In November 1808, at the age of fifteen, Dr. Grant entered the University of Edinburgh, where he attended the Latin and Greek Classes. A year later, having already attended lectures on chemistry and anatomy, he commenced the study of medicine, to which the next four years were devoted; and in June 1814 he took his degree as Doctor of Medicine, having previously (in May) acquired the Diploma of the Royal College of Surgeons of Edinburgh. His inaugural dissertation was entitled 'De circuitu sanguinis in fœtu.'

In 1815 Dr. Grant resolved to devote the money which he had inherited from his father to the completion of his medical and scientific education; and with this purpose he travelled for more than four years on the continent of Europe, during which period he visited Paris, Rome, Pisa, Padua, the various capitals of Germany, Prague, Vienna, and the Universities of Switzerland, returning by way of Paris to London. Much of his journeying, especially in search of beautiful scenery, for which he had always a strong taste, was performed on foot; and he described himself as having travelled on foot at this time several thousand miles, and crossed the Alps seven times and the Apennines four times.

In the summer of 1820 he returned to his native city, where he seems to have attempted to establish himself in practice. Whether patients were few, or the doctor's habit of spending his time in the study of zoology and comparative anatomy, for which he had early acquired a predilection, stood in his way, cannot now be settled; but we know that at this period he devoted great attention to the Invertebrata of the neighbouring shores of the Frith of Forth, and that in 1824 he joined Dr. Barclay in his course of summer lectures on Comparative Anatomy. The results of his observations at this period were published in the 'Memoirs of the Wernerian Society' and in the 'Edinburgh Philosophical Journal;' and these papers include the description of those important researches on the anatomy and physiology of the Sponges, which until quite recently furnished almost all the knowledge we possessed on those curious animals.

In 1827 Dr. Grant became a Licentiate of the Royal College of Physicians of Edinburgh; but in June of that year he was elected Professor of Comparative Anatomy and Zoology in the then newly established London University, now University College. His duties, however, did not commence for more than a year, his introductory lecture having been delivered on the 23rd October, 1828. It was afterwards printed, and passed through two editions. This professorship of Zoology and Comparative Anatomy Dr. Grant held to the time of his death; for many years he was the only original Professor of the London University left on the staff of University College. For forty-six consecutive sessions he fulfilled the duties of his position, and used to boast, with pardonable pride, that in all this long period he never missed a single lecture. Even in his last session (that of 1873-74) he gave five lectures a week. The remuneration that he received for this devotion to his duties was but small. For years the only stipend attached to his office was derived from the fees of the students attending his course of lectures; and as attendance at these was not compulsory, his classes were never very large. The average number seems to have been between thirty and forty. That under these circumstances the *res angusta domi* pinched their Professor of Comparative Anatomy pretty severely seems to have dawned upon the Council of University College about the year 1850; and acting upon this impression they gave him, in addition to his class-fees, an annual salary of £100. About this time also a number of influential scientific men, anxious to rescue one of the most distinguished of British naturalists from a state of poverty which was known to press hardly upon him, raised a testimonial

fund, which enabled them to present him with a microscope as a mark of their personal esteem and to purchase for him an annuity of £50. Subsequently Dr. Grant succeeded to the property left by his brother Francis, an Officer of the Madras Army, who died childless in 1852; and thus, for the last twenty years of his life, he was placed in easy circumstances.

As already stated, Dr. Grant continued the active discharge of his professorial duties to the end of the Academic Session of 1873–74; but he felt that his powers were failing him, and proposed in his next session to reduce the number of his lectures from five to three weekly. That this resolution was not come to without reluctance, and perhaps some feeling of mortification, we may be sure; but unfortunately the sacrifice was made in vain. In August 1874 Dr. Grant was attacked by a dysenteric disease, by which his strength was so completely exhausted that he died on the 23rd of that month. He left all the property that he possessed, including his collections and library, to University College, thus benefiting after his death the Institution which he had served so faithfully during life.

Dr. Grant was elected a Fellow of this Society in 1830, and a Fellow of the Royal Society in 1836. He also belonged to the Linnean and Zoological Societies.

In estimating the influence of Dr. Grant upon the progress of science in this country, we must not be guided solely by his published works, which are comparatively few, although some of them are of great value. As a lecturer he was exceedingly clear and fluent; and for many years his teachings were considerably in advance of the accepted views of his contemporaries. From a very early period of his career he held the doctrine of the origin of animal forms by descent with modification. His activity was chiefly in the direction of Comparative Anatomy. In the Session of 1833–34 he delivered a course of lectures which was published in the 'Lancet,' and formed the best treatise on comparative anatomy then extant in the English language. This success probably induced him to commence in 1835 a great work entitled 'Outlines of Comparative Anatomy,' only a portion of which was published. In 1833 he delivered a gratuitous course of lectures on Zoology and Comparative Anatomy to the Members of the Zoological Society. In 1837 he was appointed Fullerian Professor in the Royal Institution, and he afterwards held the Swiney Lecturership. He was the author of the article "Zoophytes" in Brewster's 'Edinburgh Encyclopædia,' and of several articles, including that on the Animal

Kingdom, in Todd's 'Cyclopædia of Anatomy and Physiology.' His original memoirs appeared in the Edinburgh Philosophical Journal, Brewster's Journal of Science, and the Transactions and Proceedings of the Zoological Society.

Dr. Grant's only contribution to our publications is a short note "On the Structure and History of the Mastodontoid animals of North America," which appeared in the third volume of our Proceedings. His other geological papers are "On a Fossil Tooth found in a Red Sandstone above the Coal-formation in Berwickshire" (Edin. New Phil. Journ. vol. xvi.) and "On the Impressions of Footsteps of *Chirotherium* in the Stourton Quarries at Liverpool" (Mag. Nat. Hist. vol. iii.). It must be mentioned, however, that in every session he delivered a course of lectures on Palæontology at University College.

The Rev. Charles Kingsley, M.A., D.C.L., F.L.S., Chaplain in Ordinary to the Queen, and Canon of Westminster, was a representative of one of the old Cheshire families, and was born in the year 1819. After studying at King's College, London, he proceeded to Cambridge, where he took an honourable degree both in classics and mathematics. Though better known as a poet and a novelist, his botanical and geological acquirements were of no ordinary kind. His deep love of nature, so apparent in all his writings, the naturally speculative character of his mind, and his anxious longing after truth, all combined in making him take an intense interest in the grand questions involved in geological inquiries. Although, owing to the many-sided and diffusive nature of his genius, he may not have carried his studies so far as to entitle him to take any foremost place in the ranks of science, there are few modern writers who have done more to promote intelligent inquiry and a taste for scientific knowledge among all classes. He became a Fellow of this Society in 1863; but his 'Town Geology,' which has passed through more than one edition, is his only separate work on that science. It embodies a series of lectures delivered two or three years ago to the members of the Chester Natural History Society, and contains an extremely able and interesting popular summary of the principal facts which Geology has revealed, but is intended rather to awaken a desire for further knowledge than in any way to serve as a handbook of the science.

He died at Eversley, Hampshire, of which place he had been upwards of thirty years the rector, on the 23rd of January last. It

appears probable that, during his travels last year in North America, the keen air of the Rocky Mountains brought on an affection of the lungs, which ultimately proved fatal.

Dr. Neil Arnott, F.R.S., had been a Fellow of this Society since the year 1847, and died on March 2nd, 1874, in his 86th year, having been born in 1789. Devotedly attached to science, geology was with him an accessory, and not his principal, pursuit. In addition to his medical treatises, his 'Elements of Physics,' published in 1827, at once raised him to a high position among those who were then actively striving to popularize and extend scientific knowledge; but it is doubtful whether the useful application of scientific principles which was displayed in the invention of the Arnott's stove, the Arnott's ventilator, and his water-bed, have not as much conduced to his well-earned fame as his scientific writings or his medical skill. His magnificent donation of £1000 to each of the four Scottish Universities, for the promotion of the study of experimental physics among the medical students, and his placing £2000 at the disposal of the Senate of the University of London to found a scientific scholarship, attest alike his success in life and his devotion to the cause of science.

Dr. Hermann Josef Burkart was born in Bonn on the 12th May, 1798, and after receiving the first part of his education at the Lyceum of that town, and finishing it under private instruction, the anticipation of great activity in mining affairs in Rhenish Prussia led him in 1816, in association with his friend Baron von Gerolt, afterwards ambassador in Washington, to devote his attention to mining. In August 1816 he was sent by the Oberbergamt in Bonn to the district of Saarbrück, in order that he might receive practical instruction in the coal-mines there. On the 17th October, 1817, after passing an examination, he was admitted as a royal mining student, and continued his training in the mining district of Siegen until the beginning of 1819, when he went to the University of Bonn, where he chiefly attended the lectures of Nœggerath, G. Bischof, and Von Münchow. Nöggerath especially exercised a great influence upon him; an intimate friendship sprang up between the master and the zealous pupil, which lasted over 50 years, and only terminated with the death of the latter.

During his attendance at the University, which continued until the summer of 1821, Burkart spent his vacations in travelling

through interesting mining districts; and thus, when he went to Freiburg in 1821, he was remarkably well prepared to profit by the instruction there offered to him. Leaving Freiburg in 1822, he visited Saxony and Silesia, and returned at the end of the year to Bonn, where he received an appointment under the Oberbergamt, and was commissioned to make an examination of the district of Kreuznach, a task which he satisfactorily accomplished in 1823. The geognostic portion of the results obtained by him appeared in Nöggerath's 'Gebirge in Rheinland und Westphalen,' and gave evidence of the high qualifications possessed by the author for such investigations.

After he had filled one or two other positions in his native province, new prospects opened before Burkart. About the year 1824 many companies were established in England for reworking the abandoned silver-mines of Mexico; in February 1825 Burkart came to London, and was appointed by the Mining Company of Tlalpujahua their chief technical officer. From 1825 to 1834 he resided in Mexico, managing for the first three years the mines of the above-mentioned company, and afterwards those of the Bolannos Company. It was during his residence in that country, namely in 1833, that he became a Fellow of this Society.

While in Mexico, Burkart sent, chiefly to his friend Nœggerath, many important statements relating to the geognostic characters and mines of that region; these were published in Karsten's 'Archiv für Bergbau und Hüttenwesen.' In 1836, after he had returned to live in Bonn, he published his 'Aufenthalt und Reisen in Mexico' (Stuttgart, 2 vols. 8vo), in which these scattered observations were brought together and completed. In the same year the University of Heidelberg conferred upon him the degree of Doctor of Philosophy. In 1837 he was nominated Secretary to the Oberbergamt in Bonn; and after passing through several intermediate grades, he became mining councillor in January 1858. This position increasing infirmities compelled him to give up in June 1867; but such was the respect which his zeal and activity had inspired, that he was nominated an honorary member of the mining council, with a right to take part in the deliberations of that body, and at the same time received the order of the Second Class of the Red Eagle, with oak-leaves. From this time until the day of his death, although constantly suffering from ill health, Burkart wrote many papers on geological and mining subjects. He died on the 4th of November last.

None of Burkart's works were communicated to this Society. His principal publications are:—A pictorial representation of the Structure of the Crust of the Earth, in 5 plates, prepared jointly with Nöggerath, and published in 1838; a translation of Mantell's 'Wonders of Geology,' published in 1839; and the above-mentioned work on Mexico. His shorter memoirs and papers are very numerous, and relate principally to the geology and mineralogy of Central America; they appeared chiefly in Leonhard and Bronn's 'Neues Jahrbuch für Mineralogie &c.,' the Reports of the Natural History Society of Rhenish Prussia and Westphalia, and the Journal of the German Geological Society.

The name of M. Sylvain Van de Weyer, who for many years represented Belgium as Minister Plenipotentiary at the Court of St. James's, was better known in diplomatic and literary circles than among geologists. He had, however, for twenty-five years been a Fellow of this Society, and before entering on his political career had held a distinguished position in the Museums of Science and Letters at Brussels. The important part he took in the establishment of the kingdom of Belgium, and the popularity which he gained as its representative in this country for upwards of twenty years, are too well known to require any comment. He died on the 25th of May last, at the age of 72.

Sir John Rennie, F.R.S., the distinguished Civil Engineer, was born on August 30, 1794. His father, Mr. John Rennie, had acquired great reputation as an engineer, having been employed in many of the great constructive works of the early part of the present century. Three of the bridges which span the Thames in London were designed by the elder Rennie, and in carrying out the construction of two of them (Southwark and Waterloo Bridges) he was assisted by his son. The construction of new London Bridge was entirely the work of Sir John Rennie; and on the occasion of its being opened he received the honour of knighthood at the hands of King William IV.

After his father's death in 1821 Sir John Rennie was appointed his successor as Engineer to the Admiralty, and the completion of many works that had been commenced was thrown into his hands. Among these were Ramsgate Harbour and Plymouth Breakwater, and the drainage of the Lincolnshire fen-district. Other important public works executed by him are Sheerness Dockyard, the docks at

Whitehaven, a portion of the docks at Cardiff, and the Royal Clarence Victualling Yard at Plymouth, the last with the cooperation of his brother Mr. George Rennie. He died on 3rd September last, after several years of retirement from active life.

Sir John Rennie was elected a Fellow of this Society in the year 1830. He does not appear to have ever written on any geological or purely scientific subject; but he took great interest in the progress of science, and in his capacity of a distinguished engineer, especially in hydraulic constructions, geological questions must often have been presented to his mind. Upon all subjects connected with the construction of harbours, drainage, and hydraulic engineering generally, he was regarded as one of the highest authorities in Europe; and his published writings on these matters may be regarded as placing him in some degree upon the list of geological authors. His high attainments as an engineer procured him several foreign orders of Knighthood, and the membership of the Academy of Sciences of Stockholm and of the Austrian Society of Civil Engineers.

Mr. John William Pike, the second son of Mr. Robert H. Pike, of Camborne, was born on the 26th November, 1839. He was educated at Stonyhurst College, and was afterwards articled to the eminent engineers Messrs. Fairbairn and Sons, of Manchester, with whom he remained five years. In 1862, on the recommendation of the then Mr. William Fairbairn, he entered the Engineering Department at Portsmouth Dockyard to study Naval Architecture. In 1864 he became the partner of Mr. Henderson, of Truro, a civil and mining engineer; and in 1866 contributed a short but instructive paper to the Proceedings of this Society on some remarkable heaves at Penhalls Mine, near St. Agnes, in Cornwall.

Shortly afterwards he proceeded to Mexico, and was in that city during the long siege by the Republican forces, a graphic account of which from his pen was published in the 'Times' newspaper.

After the close of the Revolution he acquired a share and took the management of the Encarnacion Iron-works in Timapan; he was also often engaged in inspecting mining properties, and his reports were always valued, not only for their straightforwardness, but also on account of the knowledge of geology and mineralogy that they displayed.

Mr. John Pike remained manager of the Encarnacion Works until his return to England in 1872. Having married, he gave up his intention of returning to Mexico, and became the managing partner

of the Tuckingmill Foundry Company, in Cornwall, which he conducted with his usual ability. On the 18th July, last year, he gave the annual treat to the employés at Gwithian, a small sea-side village near Hayle, and whilst bathing in a retired spot he was carried out to sea by the treacherous undercurrents, and was drowned before assistance could be rendered.

He was of a genial, frank disposition, and was universally respected by all with whom he came in contact; and it may be truthfully said of him that, during his short life, he made numberless friends and not a single enemy.

Professor William Macdonald, M.D., F.R.S.E., F.L.S., was born on April 21st, 1797, and died on January 1st, 1875. He was devotedly attached to natural history in all its branches, and spent much time and money in forming extensive collections, with which, in his later years, he enriched the Museum of the University of St. Andrews, where, since the year 1850, he had occupied the Chair of Civil and Natural History. He became a Fellow of this Society in the year 1819, but, during his fifty-five years of membership, he does not appear to have communicated any memoirs to the Society.

When it is borne in mind that this is the first occasion on which an Anniversary Address has been delivered in this room, it will, I am sure, be felt that I cannot well do otherwise than commence my task by congratulating the Society on being at last in full possession of the handsome and commodious apartments which, by the liberality of Her Majesty's Government, have been provided for our use. We may indeed look around us with some pride at the thought of the Science which we cultivate having its utility and public importance recognized in so substantial a manner as is evinced by the dedication of a building on such a scale and in such a position to her votaries. It is true that the recognition of the services which Geology has rendered, and is still likely to render, to the state dates back to the time when, upwards of 40 years ago, the Government of the day allotted to our Society the rooms which it has during so long a period occupied at Somerset House, and which many of us must still regard with that peculiar affection which attaches to an old home. There can, however, be no question as to the vast superiority of the accommodation we have here provided for us over that which we have left; and

whether we turn to the Library, the Museum, or the Meeting-room, we cannot but feel how far larger and better is the new home provided for our books, our specimens, and ourselves.

To some few of us, no doubt, the central situation of Somerset House had its advantages; but, to the majority, I believe the more western position of Burlington House is far more convenient. Even were this not the case, the propinquity in which our present apartments are to those of the Royal, Linnean, Chemical, and other Societies, with the objects of which certain branches of geological science have much in common, ought alone to turn the scale in favour of such a change of locality as has now been effected.

There is, however, another consideration in our case which affects this Society in a far more important degree than any of the others which have been mentioned. It is well known in the Society that of late years want of space was not the only cause which compelled us to restrict our collections to foreign specimens, and to such specimens only of British origin as served to illustrate or confirm descriptions given in memoirs addressed to the Society. It was felt that the best home for a collection of British specimens was at the head quarters of the Geological Survey, the Mining Record Office, and the Royal School of Mines, in the Museum of Practical Geology in Jermyn Street. There, with able palæontologists at hand, with an extensive and active staff pursuing their careful investigations over the whole of this country, the collections are year by year becoming more and more complete; and it would have been a mere waste of space and money for this Society to attempt in any way to compete with an Institution placed under such favourable circumstances, and which was not a rival but a friend. In moving to our present apartments (a removal which was for many years foreseen), the wisdom of the decision on the part of the Society not to form any extensive collection of British fossils becomes even more apparent; for the contiguity of our Museum to that in Jermyn Street is so immediate that the two establishments might almost be regarded as one, were it not for the differences in their constitution.

The proximity of so magnificent a collection as that in the Museum of Practical Geology will, I am sure, be found of even greater value to the Fellows of this Society than was anticipated, and is certainly one of the circumstances attending our removal on which the most hearty congratulations may be offered.

Nor, on the other hand, is the contiguity of the apartments of this Society to the Government School of Mines without its correspond-

ing advantage to those who are there prosecuting their studies, especially if they happen to be of the number of our Fellows. Indeed, from whatever point of view we regard it, the collocation side by side of two institutions, each calculated in some degree to supplement the wants of the other, must always be regarded as a most felicitous circumstance.

It is therefore with some feeling of dismay that I find that steps have been taken, and I hear rumours of others still possibly to be taken, which seem destined to have the effect of more or less breaking up that knot of intimately connected and kindred institutions which now finds its home in the Jermyn-Street Museum. The School of Mines, a most valuable and useful institution, appears in its nature so very closely allied with the Mining Record Office and the Geological Survey and its Museum, that it can hardly be severed from them without injury; and the same causes which have led to the removal of a portion of its course of instruction from Jermyn Street, if they result in its entire removal, would seem to threaten the other kindred institutions. It is, indeed, possible that the geological collections in the new Natural-History Museum which is being erected at South Kensington may, to some extent, serve the purposes of the students at the School of Mines. They can, however, it appears to me, be neither so serviceable nor so accessible for study as those in Jermyn Street, which it seems hardly wise not to utilize to the utmost. Reasons with which I am not acquainted may have led to the partial removal of the course of instruction in the School of Mines to South Kensington. But if there is any truth in the report that there is an intention to remove the remaining portion of the course to that, in spite of all railways, by no means central spot, and if it be true that the cause is want of room and proper accommodation for the efficient working of the School in Jermyn Street by the Professors still left there, the question naturally arises why there should be the slightest difficulty in providing what is wanted in the neighbourhood, and that at moderate cost.

Whatever may be done, I trust that under any circumstances the day may long be distant when the three closely allied institutions which have so long and so well worked together shall be dissociated, or the headquarters of the Geological Survey and of the Museum which has been formed under its auspices be transferred to a distance from the apartments of this Society.

It may be that in making these remarks I have strayed beyond the strictly legitimate bounds of the occasion; I trust, however, that

I shall be pardoned for following the dictates of my feelings in this matter; for, whatever may be the opinions held upon the subject, there can be no doubt of the interests of this Society being much involved in such a question; and I cannot help suspecting that the views which I have ventured to express are far from being in disaccordance with those of many whom I am now addressing.

I must not, however, dwell longer upon this subject, but will rather turn to another point in connexion with our removal which will probably be of even more general interest. I mean the position of the Society at the present day as compared with that it occupied at the period of its removal to Somerset House.

The Geological Society*, which was founded on Nov. 13, 1807, first occupied apartments of its own early in 1809 at No. 4 Garden Court, Temple. In 1810 the Society removed to No. 3 Lincoln's Inn Fields, and again in 1816 to Bedford Street, Covent Garden. On the 23rd of April, 1825, while still in Bedford Street, the Society was incorporated by Charter, the Rev. W. Buckland, D.D., being at that time President, and Charles Lyell, Esq., George Poulett Scrope, Esq., and Thomas Webster, Esq., being Secretaries. On May 20th in that year the Society numbered 390 Members, and in the January following it possessed an invested capital of £178 5*s.* 7*d.*, 3 per cent. consols.

The removal from Bedford Street to the apartments in Somerset House, under a grant from the Lords Commissioners of His Majesty's Treasury, took place in the autumn of 1828, and some additional rooms were granted in 1834. It is already on record in the 'Proceedings'† of our Society that the grant of these Apartments was obtained through the mediation of the President and Council of the Royal Society—a society which, though at the time of our foundation somewhat jealous of our separate existence, has ever since been on all occasions most ready to forward the interests of the Geological Society as well as of the science it cultivates.

The first Annual General Meeting held in Somerset House was on Feb. 20, 1829, or almost exactly 46 years ago. The President on that occasion was Dr. Fitton; the Vice-Presidents were Arthur Aikin, Esq., the Rev. W. Buckland, D.D., Charles Lyell, Esq., and the Rev. A. Sedgwick, the Secretaries and Foreign Secretary being W. J. Broderip, Esq., R. I. Murchison, Esq., and H. Heuland, Esq.; while

* For some of these facts I am indebted to a paper in 'The Hour,' for Nov 5, 1873, from the pen of Mr. W. S. Mitchell, F.G.S.

† Vol. i. p. 111.

on the Council we find the well-known names of the Rev. W. D. Conybeare, John Crawfurd, Michael Faraday, G. B. Greenough, and Leonard Horner, together with Davies Gilbert, Esq., Pres. R.S., and J. F. W. Herschel, Pres. A.S. At the election which took place that day Prof. Sedgwick became President, and Charles Lyell, Esq., Foreign Secretary, and among the new Members of Council we find the names of Prof. Lindley and Dr. P. M. Roget.

It is sad to think how many of these illustrious men have, in the course of nature, passed away; but the very contrast makes us rejoice the more that we have still among us, covered with well-earned honours, the Secretary of 1825 and the Foreign Secretary of 1828, Sir Charles Lyell*, and that other distinguished geologist whom of late years we have, unfortunately, not so often seen among us, his co-Secretary of fifty years ago, Mr. G. Poulett Scrope. Among the Fellows elected during the year ending February 1829, may also be mentioned Mr. W. J. Henwood, to whom we have this day presented the Murchison Medal, and Sir Philip de M. Grey Egerton, who has so largely contributed to our knowledge of fossil fishes.

Looking at the numerical and financial condition of the Society, we find on the 31st December, 1828, that there were 418 Fellows, 51 Honorary Members, and 52 Foreign Members, in all 521, as against 1209 Fellows, 3 Honorary Members, 38 Foreign Members, and 40 Foreign Correspondents, in all 1290, at the present day. This shows a remarkable increase of 769 as compared with our numbers forty-six years ago. The contrast is still more remarkable if we compare the number of Ordinary Fellows elected during each of the two years selected. Between February 1828 and February 1829 their number was 30, while in the year which terminates to-day no less than 88 have been elected into our body.

Our financial condition will perhaps be best expressed in a tabular form:—

	1829.	1874.
Ordinary receipts during the year	£1242 8 6	£2567 4 2
Ordinary expenses	924 10 3	2093 9 4
Of which, for publications	227 2 10	987 6 9
Valuation of the property of the Society, exclusive of unsold publications, &c. ..	632 7 9	5796 18 11

In 1828, as was the case in 1874, it was found desirable to open a special subscription towards the expenses of removal and the fitting up of the new apartments; and for that purpose the sum of

* Our rejoicings were turned into sorrow by the death of Sir Charles Lyell three days after the delivery of this address.

£928 8*s.* 6*d.* appears to have been raised, while a further sum of about £550 had to be charged against the General Fund. On the present occasion our Removal Fund has amounted to nearly £1100, while a sum of about £800 will be charged in the General Account. The number of papers read in the period between the two anniversaries was, in 1829, 21, while in the year just closed no less than 65 papers have been communicated to the Society. It would be invidious to attempt any comparison between the papers of the two periods as to their importance and merits; but, so far as stratigraphical geology is concerned, I think that many of the memoirs communicated during the last year will hold their own when brought into comparison with those of the former period; while as regards the palæontological essays there can be little doubt that the advance of knowledge in that department has rendered the more modern papers of decidedly higher value.

With regard to new geological facts which have been developed during the past year, it will not, I trust, be expected that I should have much to say. I was in hopes, however, that the sub-Wealden boring which has in so exemplary a manner been prosecuted under the auspices of Mr. Henry Willett, F.G.S., might by this time have thrown some light on the extension of the older rocks under the south-east of England, and on the possibility of new treasures of mineral wealth, in the shape of coal, underlying the surface at a not inaccessible depth. In this hope, owing to a series of vexatious accidents, I have been disappointed. But though for the moment the work has been stayed, those who have it in hand are not discouraged; and I trust that before many months are over, the new boring which it has been found desirable to commence may have attained the same depth as that which has now been relinquished, and that before another anniversary comes round, the question whether the Palæozoic rocks are to be found at a depth not exceeding 2000 feet from the surface, near Battle, may have been definitely solved. In the mean time the boring has not been without its practical utility; for by its means have been found beds of gypsum, of sufficient commercial value for them to be worked, in what appear to be strata of Purbeck age. The absence of Coral Rag between the Kimmeridge and Oxford Clays, which here seem to show no distinct line of division, has also been ascertained.

Looking to our future prospects, I may observe that the question of a tunnel beneath the English Channel, which formed the subject of a valuable paper communicated by Professor Prestwich to the Institu-

tion of Civil Engineers in December 1873, is again occupying public attention, especially in France; and it appears probable that some practical steps will shortly be taken in connexion with it, which, whatever their commercial results, cannot do otherwise than afford many interesting facts to Geologists. Should the work be proceeded with, let us hope that the Channel may prove to occupy a valley of erosion, to some extent subjected to slight and gradual subsidence, and not to have originated in one of those vast and gaping fissures which have been so freely invoked as the causes of most of the valleys which are not at present submerged.

From the Arctic Expedition which is now being so systematically organized it is to be hoped that some accession to our geological knowledge of the circumpolar region may be made. Should the discoveries of those successive floras with which we are already acquainted, and the existence of which it is so hard to reconcile with their present Arctic position, be extended into still higher latitudes, there will probably be a rude collision between existing astronomical theories as to the permanence of the position of the poles of our earth and stubborn geological facts. On this point, however, it may appear somewhat premature to speculate.

If the recent attempts to introduce European methods of mining and metallurgy into China prove successful, we may look for a great extension of our knowledge of the Geology of Eastern Asia in general, as well as of the vast coal-fields of that Empire in particular.

I now turn to a question on which it will perhaps be expected that I should offer some observations, more especially as in the last Address, delivered from this Chair, our late noble President, in a manner, bequeathed the subject to me. I mean the antiquity of the human race, and the geological evidence on which the belief in that antiquity mainly rests. I venture to hope that in wandering through that interesting border land which lies between the provinces of Geology and Archæology, I shall be pardoned if I am compelled to keep in what are, to many Fellows of this Society, well-known and even well-trodden paths, and if I am unable to point to any absolutely new landmarks which will serve as trustworthy guides to future explorers.

The evidence we shall have to consider is of various kinds, but may be generally classified under two heads—the one being the character of the *fauna* which is found associated with the human relics, and the other the amount of the geological changes which have taken place in the surface configuration of the earth since the

period when those relics were deposited in the positions in which they are now discovered.

In speaking of human relics, I of course include not only any portions of the human skeleton, but also those works of art, however rude, such as implements formed of stone, which from their analogy with the implements still in use by modern savages, as well as from their evidently artificial origin, testify to an amount of design and skill in those who fashioned them, such as we can only attribute to members of the human race. It is true that, even at the present time, there are to be found some few who deny, in a more or less positive manner, an artificial origin to the implements found in the ancient gravels; but to any one with an unbiassed mind, and with the slightest acquaintance with the stone tools and weapons of more modern days, it would seem a mere waste of time were I here to insist on the evident proofs of human workmanship which are to be found upon them. No doubt there are among them some so rude and so slightly wrought that it requires a practised eye to recognize their artificial character; but that such rude instruments should exist is quite in accordance with what might have been expected among any race still in a low stage of civilization; and, as a rule, in all cases where these rude, or, as some may choose to term them, doubtful forms are found, there also occur other and more highly finished specimens, of the human origin of which there can be no reasonable doubt.

I need hardly say that in Europe, at all events, we have historical as well as archæological evidence of a gradual development of material civilization; and that a Stone Age, when cutting-instruments were made of stone, the use of metals for such purposes being unknown, has long been accepted by many students of antiquity, and is now almost universally recognized as having immediately preceded the Bronze and Iron Ages. The implements of this Stone Age, the transition of which into the Bronze Age has been traced in various countries, are usually associated with a *fauna* but little different in character from that of the present day; and many of them have been sharpened by grinding at the edges. The implements with which we are at this moment concerned are, on the contrary, found associated with a fauna now for the most part either locally or absolutely extinct, and are, so far as at present known, never ground at the edge. They are, moreover, different in general form. These differences I insisted on when, in conjunction with Mr. Prestwich, I was bringing the discoveries made by Mons. Boucher de Perthes

in the Valley of the Somme before the antiquaries and geologists of this country in 1859. I also pointed out that the race of men who fashioned the implements found with the earlier fauna must have passed away long before this portion of the earth was occupied by the primitive tribes by whom the more polished forms of stone weapons were fabricated, in what had until then been regarded as remote antiquity—though I considered it premature to speculate on the lapse of time which separated the primæval race whose relics were found fossilized in the gravel from the earliest occupants of the country to whom history or tradition could point. This necessity of distinguishing between the two Stone Periods has ever since been fully acknowledged, and the terms Neolithic and Palæolithic, first applied to them some years later by Sir John Lubbock, are now in general use.

It is with the Palæolithic Period, to which not only the implementiferous valley-gravels, but also many of the ossiferous caverns are to be assigned, that we are now concerned. It will of course be conceded that this period may have been, and probably was, of long duration in Western Europe, and that neither all of these drift-deposits nor all of the cave-remains are of precisely the same age, nor, in most cases, can any exact chronological coordination be established between the two classes. While in some few caverns the organic contents, the implements, and the geological features point to a contemporaneity with some of the old valley-gravels, in others they are suggestive of a much later date; and their correlation with the other class of deposits is more difficult, though, so far as at present known, they still appear to be separated by a broad line of demarcation from the earliest remains of the Neolithic period. The entire history of cave-deposits has so lately been discussed in a masterly manner by Mr. Boyd Dawkins in his book on "Cave-hunting," that I have the less hesitation in leaving the whole of what I venture to regard as the later series of caves out of consideration; nor, with regard to the evidence of the antiquity of man afforded by the mammalian remains with which human relics have been found associated, need I do much more than cite the conclusions at which so industrious an observer has arrived. As already observed, the most important members of that Pleistocene fauna which is alike characteristic of the valley-gravels and of the early ossiferous caves are now extinct, or else are now no longer denizens of this country: these are the lion, hyæna, hippopotamus, two species of elephant, two of rhinoceros, the brown and grizzly bears, urus, bison, Irish elk, reindeer, marmot, lemming, glutton, and musk-sheep.

Such a remarkably mixed assemblage of species readily divides itself into three groups—the southern, the temperate, and the northern; and seems to bear distinct evidence, as was long ago pointed out by Professor Prestwich, of a considerable degree of winter cold. As to the summer heat, the evidence is less cogent; but, as Mr. Dawkins observes, whatever may have been the case with the lion and hyæna, "it is very unlikely that so aquatic an animal as the hippopotamus could have ranged from southern Europe as far north as Yorkshire under any other than temperate conditions. It could not have endured a winter sufficiently severe to cover the rivers with a thick coating of ice without having its present habits profoundly modified; and such an alteration of habits would certainly leave its mark in other modifications in the fossil skeleton than those minute differences which have been observed when it is compared with the living *Hippopotamus amphibius*."

On the whole, the most reasonable method of accounting for this admixture of forms seems to be that of regarding it as due to the continual "swinging to and fro over the same region of the arctic and temperate animals, like the seasonal migrations according to the summer heat and winter cold, such as those which are now observed to take place in Siberia and North America."

But such migrations presuppose the power of retreat and advance; and this circumstance leads to the conclusion that, during at all events some part of the time when the deposits containing the remains of this fauna were being accumulated, there were no impassable barriers between what are now the British Isles and the continent. There is, indeed, evidence (as was long ago pointed out by Mr. Godwin-Austen*) that during the Pleistocene Period the area of the English Channel, previous to its occupation by the waters of the ocean, was in the condition of dry land.

The greater part of this area appears to have been depressed in Pleistocene times, though there can be little doubt that there has been a considerable tract of country subsequently eroded by the sea; and it even appears possible that the area of depression below the sea-level did not extend so far eastward as Dover, and that in that neighbourhood an ancient isthmus has been cut through by the waves. Apart, then, from any question as to the lapse of time which, judging from all analogy, would be necessary for so great a change in the fauna as that which has supervened since the age of the cave-deposits, it is evident that great physical changes have taken place

* Quart. Journ. Geol. Soc. vol. i. p. 91.

in the configuration of the country, and the relation of the sea to the land, since the days when the Pleistocene animals flourished in these regions.

In considering this question, however, it must not be forgotten that Mr. James Geikie, in his admirable work on the "Great Ice Age," has most ably controverted the theory of periodical migrations as adopted by Mr. Boyd Dawkins, relying partly on the want of analogy between the conditions of Britain and those of northern Asia and America, partly on the non-migratory habits of some of the animals, and partly on the probability that, during the last continental condition of our islands, snow-fields and glaciers existed in our mountain regions, betokening a climate quite unsuited to the needs of the southern mammalia. As, however, Mr. Geikie assigns the palæolithic deposits mainly to an interglacial age when our country was joined to Europe across the bed of the German Ocean, it matters not for my present purpose which view may for the moment be adopted. Both authors are agreed as to the character of the country which these Pleistocene animals frequented, and both are agreed as to the great physical changes which have since that time taken place. For, after all, it appears to me that it is mainly as indicative of changes in physical conditions that the testimony of the fauna is of value; so that, important as at the outset it would appear to be, it must be regarded as but subordinate and corroborative in its character, though, from the broad line of distinction which can be drawn between the faunas of palæolithic and neolithic times, it is still of high significance.

Let us now briefly review the phenomena of the occurrence of remains of human industry in drift-deposits of gravel, sand, and clay. Along most of our river-valleys, at varying elevations above the levels of the existing streams, such deposits occur, frequently containing remains of that Pleistocene fauna of which mention has already been made, and, in not a few instances, implements fashioned by the hand of man. In some cases similar deposits are found in places which appear to be unconnected with existing river-valleys, capping cliffs along the sea-shore or hills rising in the middle of extensive plains. Of the origin of such deposits there can be little doubt, as the absence of marine remains (except, in one or two instances, at a low level and almost if not quite accessible to the tides of the present day) and the abundant presence of mammalian bones and of land and freshwater shells prove them to be due to the action of fresh water. Though similar in their general constitution

over a considerable area in France and Britain, they cannot be regarded as forming isolated portions of one extensive stratum, partly on account of their great range in level within comparatively limited areas, but mainly, as Prof. Prestwich has pointed out, because the constituent portions of the gravels are limited to the rocks within the existing basins of the rivers near which the beds occur. They must, then, be regarded as river-deposits; and even in those cases in which it is difficult or impossible to connect them with any existing river-valley, we shall be justified in accepting them as affording evidence of the former existence of such valleys in which they were deposited. When once this view of the fluviatile origin of the implement-bearing beds has been accepted (and I do not see how any impartial inquirer can reject it), we appear to have some means at command for estimating the antiquity of the beds; for it is evident that if we could but ascertain the rapidity of the erosion of the river-valleys, we might assign the period necessary for producing the observed results.

When, however, we come to investigate this point, we at once find that there are so many varying elements to be taken into consideration, that even an approximate calculation seems hopeless. Greater rainfall, greater frosts, more rapid thaws, and, in porous soils such as chalk, even a difference in the depth of the valley below the surrounding hills or tableland will all materially affect the rate of erosion. The effect of the three first-mentioned causes must be evident to all; but that last cited may require a few words of explanation, though I have already elsewhere endeavoured to show how this cause also operates in assisting erosion. I need hardly say that floods are the principal agents of a river in excavating its valley—nor that in the case of streams running through a country the soil of which is so thoroughly pervious as the Upper Chalk, floods are almost unknown. So porous is the rock that even the heaviest rains of the present day are in many districts absorbed as rapidly as they fall. During the summer months but little of the rainfall penetrates to a depth of even a few feet below the surface, and it is in consequence evaporated or absorbed by vegetation. During the winter months, however, the moisture which is absorbed gravitates downwards, until it arrives at the plane of permanent saturation, the level of which is constantly varying. The subterranean reservoir, of which this plane of saturation is in fact the upper surface, may be described as forming a hill of water constantly tending to subside to a perfect level by the outflow of water from it

through springs at the bottom of valleys, or, it may be, along the sea-coast; but this tendency is in each year almost as constantly counteracted by the accession of rain from above. The inclination of the surface of this saturated hill depends on the permeability of the rock and the amount of friction, including capillary attraction, which the water would have to overcome in order to attain an absolute level. In Upper-Chalk districts this inclination, or, as it may be termed, this angle of friction, is found to be represented by a slope of from 12 to 40 feet in a mile.

For the purpose of my argument, I will assume that in a tract of chalk, say, six miles in breadth, and rising to an elevation of 160 feet between two valleys of equal depth with streams running along them fed by springs, the resistance to the passage of water is such that even after long-continued drought the surface of the subterranean reservoir is inclined towards the outflow in the valleys with a fall of 20 feet to the mile. In such a case the summit of the hill of saturation, or what may be styled the subterranean watershed, being three miles from either stream, would be some 60 feet above their level. There would then be left 100 feet of absorbent chalk above the saturated portion in readiness to receive any rain that might fall; and until this 100 feet was saturated, no water could run off the surface of the ground, and no floods could ensue, except in the rare event of a rapid thaw of snow, or of rain falling on a frozen surface of ground. But to saturate this 100 feet would require a considerably greater rainfall than is usual in these islands; so that such a district would practically enjoy an immunity from floods, and the valleys would never be exposed to torrential action. Let us now see what would be the case in the district were the valleys only 60 feet in depth, instead of 160 feet. It is evident, *ex hypothesi*, that in this case the surface of the ground in the centre of the tract, and the summit of the hill of saturation, even after a long drought, would coincide. Instead, therefore, of the rain falling on a rock absorbent to a depth of 100 feet, it would, both in summer and winter, fall on an already saturated surface, and would flow off in the same manner as if it had fallen on the toughest clay; and the whole district would, so far as floods are concerned, be under precisely the same conditions as if it were composed of the most impermeable rock.

There can, I think, be little doubt that at a time before the valleys, both in sandy and chalky districts, were excavated to their present depth, they must, even with a rainfall no greater than that

of the present day, have been subject to the action of floods far in excess of any thing that the present equable flow of their streams would lead us to suppose, and therefore that the rate at which they were excavated must have been incomparably more rapid than during the later stages of their history.

We are then driven back to the conclusion that any attempt to estimate precisely the time necessary for the great superficial changes to have taken place which we find to have supervened since the deposition of these implementiferous gravels in the river-valleys, can only lead to disappointment. We must rather judge of it by the vastness of the changes than by attempting to measure it even by centuries. Who, for instance, among those assembled in this room, accustomed as he may be to the contemplation of the grandest geological phenomena, can think of the amount of time which the excavation of this valley of the Thames must have required, without a certain amount of awe, if he associates the ages it represents with the existence of the human race in this part of the world? When we think of those human implements interred in the gravels of Acton, Ealing, and Highbury on the one side, and of Clapham on the other—interred, not by any ordinary process of burial, but merely as forming constituent parts of the ancient bed of a river which flowed at a level far above our heads—when we reflect that the excavation of this and other similar valleys could not be due to any sudden cause, but that we have evidence that during the whole process the terrestrial conditions were such as were not inconsistent with abundant animal life, our conceptions of the extent of time represented are rendered even still more vivid.

Were we, however, from any extreme of caution, to feel a doubt as to the cogency of the evidence of the excavation of the valleys by rivers flowing over nearly their present courses, and gathering their supplies from approximately the same watersheds as at present, we must turn our thoughts seawards and examine what have been the results of marine denudation since the days when the implement-bearing gravels were deposited.

At Herne Bay we find these gravels capping cliffs some 50 feet above the sea; but there the nature of the subjacent rock is such, and the present annual gain of the sea upon the land so great, that if we leave out of account the difficulty of determining the character and direction of the flow of the river which deposited the gravels, no vast antiquity appears to be of necessity implied. When, however,

we turn to our southern coast, and find that since the deposition of the Hill-Head gravels the whole bed of Southampton Water has been excavated, when we find in the gravels at Southampton Common water-worn implements at an elevation of 180 feet above high-water mark, and observe no trace of an elevation of the land to any thing approaching that extent, we perceive that the sea, though incessant in its work, must have required a lengthened period to have effected such changes as those which are there exhibited.

But when, again, we look further to the west and find the cliffs at Bournemouth capped, at an elevation of 90 to 130 feet above the sea, by gravels containing these early implements, when we can trace these gravels in their eastward course until we find them at a lower elevation on the shores of the Solent Sea, we are driven to the conclusion that they mark the course of a river flowing eastward, of which but a small portion now survives in a strangely enlarged and modified form as the Solent Sea, separating the Isle of Wight from the main land, and of which the river that deposited the Southampton and Hill-Head gravels was an affluent. Of the former existence of this old river (this ancient river Solent, as it may be termed), the Rev. Mr. Fox became convinced on other and independent grounds than those on which I came to the same conclusion. But what does its existence imply? That the valley it traversed had originally a southern slope of sufficient elevation to prevent the waters of the ancient Solent finding their way to the sea before they had passed eastward beyond where is now Spithead. In other words, we are driven to assume that the line of Chalk hills which now passes through the Isle of Wight must have been continuous, or nearly so, as far as Ballard Down, and that since the deposition of the gravels a tract of country some 15 miles long by 5 or 6 miles broad has been invaded and carried off by the waves.

But even this denudation, striking as it is, seems to be paralleled, if not exceeded, by what we find must have taken place in our eastern counties; for there it would appear that the planing down of a great part of what is now the Fen-country must have been effected subsequently to the deposition of the implement-bearing gravels. For how otherwise are we to account for a hill like Shrub Hill rising in the midst of the Fens, but capped with the gravels once deposited in the bottom of a valley? what are we to say as to the existence of implement-bearing gravels on the slope of a hill facing the Fens, like that near Lakenheath, except that during the denudation of the Fen-country the opposite slope of the valley must have been removed?

If for a moment we refer to the physical conditions under which

some of the ossiferous caves belonging to much the same period received their contents, we find them bearing like testimony with the river-gravels. Taking, for instance, the well-known Brixham Cave, in which was discovered a pointed implement analogous in character to those from the river-drift, as well as numerous remains of the Pleistocene fauna, Mr. Pengelly has pointed out that the materials of the Third Bed, in which this and several other instruments of flint were found, must have been brought into the cavern by means of fresh water. But, as he remarks, the cavern, which is only about a quarter of a mile from the sea, is 100 feet above its level, and nearly as much above the bottom of the valley immediately below the cave; so that, at the time when the fresh water was conducted into the cave, the valley must have been almost 100 feet less deep than it is at present. The testimony of rolled nodules of brown hæmatite, which must have been transported into the cavern from a hill now on the opposite side of the deep valley, appears also to be conclusive as to the non-existence of the valley at the time of their transport. It is of course possible that this valley of 100 feet deep, cut in hard semicrystalline limestone, may have existed at an earlier period, have been during some submergence filled with gravels, and have afterwards been reexcavated. But even in such a case, improbable as it may to many appear to be, there would still remain the fact of a valley having a deposit of gravel 100 feet in thickness removed from it by prolonged subaerial action subsequently to the infilling of the cavern.

Of the great geological changes in the surface-configuration of our country which Man has witnessed there can then be no doubt; and the graphic exposition of the Pythagorean doctrines by Ovid may almost be regarded as an historical statement:—

> "Vidi ego quod fuerat quondam solidissima tellus
> Esse fretum. Vidi factas ex æquore terras;
> Et procul à pelago conchæ jacuere marinæ;
> Et vetus inventa est in montibus anchora summis.
> Quodque fuit campus, vallem decursus aquarum
> Fecit; et eluvie mons est deductus in æquor;
> Eque paludosâ siccis humus aret arenis;
> Quæque sitim tulerant, stagnata paludibus hument."

But though, from the evidence of the deposits themselves, it appears impossible to arrive at any absolute conclusion as to the time involved in these changes, still, considering the numerous localities in which these implement-bearing beds have now been found, as well as other beds which, though apparently devoid of implements, yet

being of the same general character and containing the same fauna, are therefore presumably of the same date, it does appear possible that from their geological position we might ascertain some epoch beyond which their age cannot be carried, and thus be enabled to assign an extreme limit to their antiquity. I believe that I am right in stating that until within the last two or three years it was the generally received opinion of geologists that the earliest known traces of the occupation of this portion of the globe by man were posterior in time to what is known as the Glacial Period. The discovery, however, of a portion of a human fibula during the exploration of the Victoria Cave, near Settle, in a deposit overlain by a stiff glacial clay containing ice-scratched pebbles, has been regarded as conclusive that man lived in England prior to the last interglacial period. I must confess that, in common with some others, I do not regard this question as conclusively settled by any such isolated piece of evidence; and that whatever further testimony may eventually be adduced as to so early an occupation of this country by man, there are, in my opinion, possibilities, in this particular case, of the clay being either to some extent reconstituted or even accidentally redeposited, which make it safer to suspend our judgment until the evidence is corroborated.

Mr. James Geikie, however, arguing on more general and therefore on safer grounds, has come to the conclusion that the palæolithic deposits are of preglacial and interglacial age, and do not, in any part, belong to postglacial times. From their comparative absence in the midland and northern counties, and in Wales, Scotland, and Ireland (regions which have again and again been subjected to the grinding action of land ice and the destructive influence of the sea), and from their presence in districts which were never overwhelmed by the confluent ice masses, and in regions which were not submerged during the last great depression of the land in late glacial times, he thinks that in these latter districts the valley-gravels form a continuous series of records from preglacial times to the present day. He maintains that the palæolithic beds dovetail into the glacial drifts, and are overlapped by marine deposits thrown down during the final cold period; and, further, that it may be said for certain that no palæolithic bed can be shown to belong to a more recent date than the mild era which preceded the last great submergence.

If this view could be accepted, there is no doubt that, as Mr. Geikie remarks, many apparent anomalies would receive a simple and satisfactory explanation.

It appears to me, however, that there are great difficulties in accepting this view; and though I do not think that an anniversary address ought in any way to partake of a controversial character, I may venture to point out that the whole of Mr. Geikie's conclusions appear to be based on his correlation of Mr. Searles V. Wood, jun.'s lower and middle glacial beds, and even his upper glacial deposits, with the lower glacial beds and till of Scotland and the north-western districts of England. Even the general submergence of the eastern districts he assigns to another and a far earlier date than that of the Welsh area; and, indeed, he finds room for the whole of the denudation of the glacial deposits in the east of England, as well as for the excavation of the valleys as we at present find them, and the deposition of all the palæolithic gravels between those two submergences. Such views, founded on long and careful investigation, of the phenomena, though perhaps principally confined to those exhibited in Scotland, cannot be summarily and hastily dismissed; but their author will no doubt pardon those who are not prepared at once to accept them. In the mean time we must rest content with knowing that, so far as the palæolithic deposits of the east of England are concerned (and if the identity in form of the implements affords any safe chronological index, the beds of the same character in other parts of this country and the north of France are of the same date), they are all distinctly postglacial in the sense in which that term is employed by Mr. Searles V. Wood, jun.

Take, for example, the case of Hoxne, where the implement-bearing beds repose on a trough cut out in the upper glacial boulder-clay, which itself rests on middle glacial sands and gravels.

At Icklingham, again, the palæolithic gravels occur in a valley cut through the upper glacial boulder-clay, and appear to rest on middle glacial beds. At Bedford, the valley of the Ouse is cut through the same boulder-clay, many of the pebbles from which, and the subjacent beds, form constituent parts of the palæolithic gravels. The same feature prevails in the Ealing and Acton gravels, in which transported pebbles of the older rocks are of not unfrequent occurrence.

Again, near Brandon, some of the higher gravels containing the implements show a very large percentage of the quartzite pebbles from the middle glacial beds, some few of which, indeed, have supplied the material from which implements have been chipped. There can therefore be no doubt that they belong to a period subsequent to the submergence during which the middle and upper glacial beds were deposited, and to a time when the old sea-bottom had been

long enough converted into dry land for it to become habitable by man and the numerous mammals of the Quaternary fauna.

I do not, of course, wish it in any way to be implied that I regard no part of the surface configuration of our island as of preglacial or glacial date. On the contrary, I am inclined to think that many of our principal valleys were already marked out in preglacial times, and that a large proportion of the whole number were excavated to a portion of their present depth, either by the direct action of ice, or during the last emergence of the land from beneath the waters of the sea.

But though, so far as the makers of the earliest implements hitherto discovered in Britain are concerned, we cannot safely carry back their existence to preglacial times, it by no means follows that the earliest traces of the occupation even of this part of the world by man have as yet been discovered. The Abbé Bourgeois, indeed, would carry man back to Lower Miocene times, relying on implements presumed to have been found in beds of the Calcaire de Beauce, at Thenay, near Pontlevoy. He candidly acknowledges, however, that the implements offer a complete identity with those found on the surface; and I cannot but suspect some possible error of observation as to their occurrence in the beds. Did they really belong to them, we should have the remarkable fact that at that remote period, characterized by mammals as distinct from those of the present day as the *Acerotherium* is from the Rhinoceros, or the *Mastodon* from the Elephant, primæval man was fashioning implements indistinguishable from those of Neolithic times; while it is not until we come to the Sables de l'Orléannais, which are superimposed upon the Calcaire de Beauce, that we find the earliest trace of an anthropomorphous ape, in the shape of the *Hylobates antiquus*. The *Dryopithecus*, it will be remembered, belongs to the Upper Miocene.

While speaking of possible errors of observation, I may mention that in Sweden the Södertelje hut, which has often been cited as affording evidence of the great antiquity of the human occupation of that country, is no longer regarded as belonging to so ancient a period as was formerly assigned to it, but is considered as being of comparatively modern date.

But, returning to the main question, though for the present we seem unable to find any satisfactory evidence of the existence of man in western Europe before the glacial period, it by no means follows that none such will eventually be found. It must, moreover, never be forgotten that it is not in this part of the world that a naturalist would be led to look for the cradle of the human race.

This is far more probably to be sought in a warmer clime, and amidst a more luxurious vegetation, yielding throughout the year some readily available means of subsistence, both to man and to animals that would serve him as food. In the earliest as well as in later times, the centre of the migrations of the human race may well have lain in the far East, and the course of their wanderings, as in after days, been even then "westwards, towards the setting sun." Most remarkable it is that implements, which in form, though not in material, are indistinguishable from those of our river-drifts, have been found in stratified beds of uncertain age in southern Africa and in the so-called lateritic deposits of the south of India.

The first discovery of Palæolithic implements in Madras was made about ten years ago by Mr. R. Bruce Foote, of the Indian Geological Survey; but at that time the absence of organic remains in the beds containing the implements rendered it almost impossible to arrive at any satisfactory conclusion, either as to their age or mode of deposition. In the Records of the Geological Survey of India for the year 1873, Mr. Medlicott, however, gives an account of a quartzite implement of precisely the same class as those found in Southern India, which was discovered in the ossiferous deposits of the Narbadá valley. These deposits, which, by the late Dr. Falconer, were regarded as Pliocene, Mr. Medlicott sees reason to place among those of Pleistocene age. Whichever view may eventually prove to be correct, we have in India, as in Europe, evidence of man having coexisted with animals now long since extinct; and the *Elephas* or *Stegodon insignis*, the *Bos* and *Hippopotamus namadicus* seem there to take the place of the allied members of the European Quaternary fauna as his contemporaries. This Narbadá discovery remains, however, a solitary instance, but must surely lead to other and even more interesting results from the investigations of those engaged in the wide field of geological research in India.

From Borneo, where I have reason to hope there are, at the present moment, some cavern-investigations being carried on under the auspices of several Fellows of this Society, who have kindly aided me by their support, it is not, I think, unreasonable to expect that some light may be thrown on the antiquity of man in the far East. When we look back upon all the large array of facts which have been accumulated on this subject during the last sixteen years, we may find good ground for encouragement, and rest assured that in this as well as other departments of knowledge that prophecy of the wise man, which Bacon inscribed on the frontispiece of his great work, will be fulfilled—*Multi pertransibunt, et augebitur scientia.*